Notes on Practical Nursing.

THERMOMETRY.—I.

A LECTURE TO NURSES.

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The art of reading thermometers and taking temperatures is among the first lessons which you will have to teach new probationers who are sent to work under you in the ward. The technical detail (which we will consider later), is taught in a few moments, but you must be careful to lay great stress upon the necessity for accuracy and to point out to how great an extent the physician's treatment of the patient may depend upon the temperature chart.

This taking and reading of temperatures, being the first responsible duty a probationer is allowed to undertake, forms a very valuable means by which to impress upon her mind the importance of that attention to detail which characterises a good nurse.

In order that you may have some little knowledge of the subject and be able to answer the whys and the wherefores of the pupil, we will consider briefly the theory and history of thermometry, the construction of the instrument, the manner of using it, and what we may expect to learn from it.

It had long been a well-known fact that liquids expand when subjected to heat, and contract again on cooling when Galileo, in 1597, conceived the idea of constructing "an instrument for comparing the degree of active heat existing in other bodies by its effect in expanding a column of liquid." The liquids now used are chiefly mercury or alcohol, and the degree of expansion is shown by a special scale engraved on the instrument.

Mercury is invariably used as the expanding agent in clinical and scientific thermometers. It has the property of remaining liquid under an extremely wide range of temperature. It becomes solid at the very low temperature of −38·8° C. (−37·8° F.), and requires a temperature of 357·3° C. (675° F.) before it boils (pressure, 760 mm.).

Alcohol, on the other hand, which is used largely for cheap room and minimum thermometers, has a lower freezing point than mercury and a boiling point of 80° C. (144° F.), but it does not always contract evenly, and so is not accurate enough for scientific work (except in Arctic regions, where mercury would freeze.)

Fahrenheit, in 1693, first experimented with mercury as the expanding agent in thermometers; he fixed the thermometric scale still used in this country, making his freezing point 32° and his boiling point 212° above zero.

The scale was found clumsy for scientific purposes, and Réaumur in 1730 attempted to introduce the metric system, marking zero as the freezing point and the boiling point 80° above it. This system is still used in Russia and Sweden.

Celsius, in 1742, made a further improvement by raising the boiling point 20° in his scale, and marking it as 100° above zero, the freezing point. This latter system, known as Centigrade, is used almost entirely on the Continent and in all scientific work. It is necessary that nurses should be familiar with it, as it is now much used by medical men, especially in sanatorium work, in order that they may be able to compare results with those published abroad, notably in Germany. Nurses who have only been accustomed to using the Fahrenheit scale find the Centigrade at first very confusing, although it is a very simple matter to convert one scale into another.

A. To convert Centigrade to Fahrenheit multiply by 9, divide by 5, and add 32 to the result.

Example.

Boiling point Centigrade. — Boiling point Fahrenheit.

$100^\circ \times 9 = 900 \div 5 = 180 + 32 = 212^\circ$

or to reverse the process

Boiling point Fahrenheit. — Boiling point Centigrade.

$212^\circ - 32 = 180 \times 5 = 900 \div 9 = 100^\circ$

B. To convert Fahrenheit to Réaumur proceed as before, but use 4 as divisor instead of 5.

Example.

Boiling point Réaumur. — Boiling point Fahrenheit.

$80^\circ \times 9 = 720 \div 4 = 180 + 32 = 212^\circ$

Clinical thermometers require the nicest care in their manufacture in order that they may be accurate and reliable in action.

A glass capillary tube is first selected and the evenness of its bore tested. This is termed "calibration," and is done by forcing a small thread of mercury to take up different positions in the tube and ascertaining by exact measurements if the length of tube it occupies is always the same. These lengths are etched on the glass by means of hydrofluoric acid, and subdivided by a mechanical apparatus known as a "dividing engine."

A piece of glass is now fused on to the tube and blown into the shape of a bulb (to contain the mercury), another open bulb being blown at the upper end of the tube. The tube is heated to expel the air, or as much as possible, and the bulb with the open end is thrust into a vessel of mercury which flows into the tube as it cools. Boiling the mercury in the bulb and again plunging the open end in the vessel of mercury, which again is drawn up as the instrument cools, completes the process of filling.

The air is now driven out of the lower end, or closed bulb, by heat and the mercury flows from the upper end to take its place; the whole length of